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Report of the Independent Expert on the enjoyment of all human rights by older persons

Note by the Secretariat

The Secretariat has the honour to transmit to the Human Rights Council the report of the Independent Expert on the enjoyment of all human rights by older persons, Rosa Kornfeld-Matte, prepared pursuant to Council resolution 33/9. In this report, the Independent Expert examines the impact of assistive and robotics technology, artificial intelligence and automation on the human rights of older persons — a frontier issue that urgently requires further consideration. The report provides an overview of the existing international and regional human rights standards and analyses the potential and challenges of the use of such technology for the enjoyment by older persons of their human rights. This analysis is followed by the Independent Expert's conclusions and recommendations aimed at assisting States in designing and implementing appropriate and effective frameworks to ensure the promotion and protection of the rights of older persons.

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I. Introduction

1. The present report is submitted by the Independent Expert on the enjoyment of all human rights by older persons, Rosa Kornfeld-Matte, pursuant to Human Rights Council resolution 33/5. She examines, to the extent possible, the opportunities and challenges of assistive and robotics technology, artificial intelligence and automation for the full enjoyment by older persons of their human rights. The Independent Expert considers that this is a frontier issue, which urgently requires further consideration, and stresses the need for a human rights-based approach to underpin discussions on this subject.

II. Activities of the Independent Expert

2. During the reporting period, the Independent Expert visited Singapore, from 21 to 29 September 2016 (see A/HRC/36/48/Add.1), and Namibia, from 2 to 13 March 2017 (see A/HRC/36/48/Add.2). She expresses her appreciation to the Governments of those countries for their cooperation before, during and after her visits.

3. In September 2016, the Independent Expert presented her comprehensive report to the Human Rights Council, at its thirty-third session, in an interactive dialogue. On this occasion, in partnership with Alzheimer's Disease International, she launched an exhibition on older persons of photographs by Cathy Greenblat entitled *Love, Loss and Laughter: Seeing Alzheimer's Differently*. The exhibition also featured pieces from Argentinian artist Zulma Recchini, which are part of the cycle *Biografías — Grandes Mujeres*. The Independent Expert wishes to express her deep appreciation to the Government of Argentina for its remarkable dedication to the cause of older persons and for its contribution, which was instrumental in making that exhibition happen.

4. On the margins of the session of the Human Rights Council, the Independent Expert also participated in a side event, "On human rights of older persons: imperatives & desiderata", jointly organized by the Office of the United Nations High Commissioner for Human Rights and the Group of Friends of the Human Rights of Older Persons,[1] notably the Permanent Missions of Austria and Slovenia to the United Nations Office and other international organizations in Geneva and the Ministry of Foreign Affairs and Worship of Argentina, and sponsored by the NGO Committee on Ageing (Geneva) and the International Longevity Centre Global Alliance. The side event sought to explore how existing gaps at the global level could best be addressed and how States could step up their efforts in determining the best way forward further to the presentation of the Independent Expert's comprehensive report.

5. The Independent Expert also participated in a side event organized by the Geneva NGO Committee on Ageing entitled "Respecting, protecting, and fulfilling the rights of older refugees" on 19 September 2016. She called on States, United Nations agencies and civil society to pay specific attention to the needs of older refugees and otherwise displaced persons and, in particular, to older women.

6. Whenever possible, the Independent Expert participated in the meetings of the Group of Friends of the Human Rights of Older Persons. She wishes to express her sincere gratitude to the group, which was and is instrumental in ensuring that the Human Rights Council remains seized of this important matter and continues to contribute to the progressive development of the international human rights law of older persons. In this connection, the Independent Expert wishes to commend the Government of Austria — and, in particular, the Federal Ministry for Europe, Integration and Foreign Affairs and the Federal Ministry of Labour, Social Affairs and Consumer Protection — for its leadership and the decision to organize an international conference on older persons in October 2018.

[1] The Geneva Group of Friends of the Human Rights of Older Persons was launched by Argentina and Slovenia on 8 June 2016.

7. The Independent Expert also presented her comprehensive report to the seventh session of the Open-ended Working Group on Ageing, which was held in New York from 12 to 15 December 2016. The Independent Expert was pleased to note that many delegations echoed her findings that the existing international legal framework, regardless of its degree of implementation, is not enough to comprehensively and effectively ensure the enjoyment of all human rights by older persons, and that it addresses the issues of ageing from a developmental rather than a human rights approach. It will be important to capitalize on the increasing cross-regional consensus that there are many areas in which further protection of the human rights of older persons is needed to allow them to fully enjoy and actually exercise their human rights. The Independent Expert looks forward to collaborating further with, and contributing to the work of, the Open-ended Working Group on Ageing, in accordance with her mandate.

8. The Independent Expert also participated in a side event on ageism and the human rights of older persons on the margins of the Open-ended Working Group on Ageing organized by the International Longevity Centre Canada, in partnership with the University of Ottawa's Faculty of Health Sciences. In her statement, she noted the need to give a voice to older persons in international forums to promote dialogue and cooperation on issues affecting them.

9. Together with the Special Rapporteur on the right of everyone to the enjoyment of the highest attainable standard of physical and mental health, the Independent Expert participated in the fourth Annual Conference of AGE Platform Europe on 18 November 2016 in Brussels, which focused on age discrimination, while strengthening both the economic and social rights of older persons in order to empower them as equal citizens and rights-holders.

10. The Independent Expert has identified elder abuse as a priority area for her mandate and continued to undertake targeted activities in this area. She contributed to the side event on the occasion of the World Elder Abuse Awareness Day on 15 June 2017, entitled "Violence against older persons, a human rights issue", co-organized by the Office of the United Nations High Commissioner for Human Rights and the Group of Friends of the Human Rights of Older Persons, and the Permanent Missions of Argentina, Austria, Brazil, El Salvador, Israel, Montenegro, Namibia, Portugal, Slovenia and Uruguay to the United Nations Office and other international organizations in Geneva. The United Nations Population Fund, the World Health Organization, the Geneva NGO Committee on Ageing and the Global Alliance of National Human Rights Institutions also supported this event. In her message, the Independent Expert urged public action to halt the abuse of older persons by relatives.

III. Robots and rights: the impact of automation on the human rights of older persons

A. Background

11. In 1942, science fiction author Isaak Asimov formulated the Three Laws of Robotics, which, until today, underpin virtually every discussion in this area. Accordingly, "a robot may not injure a human being or, through inaction, allow a human being to come to harm. A robot must obey orders given it by human beings except where such orders would conflict with the First Law. A robot must protect its own existence as long as such protection does not conflict with the First or Second Law." As forward-looking as these laws were at the time, even predating the Universal Declaration of Human Rights, the unprecedented impact of progressive digitalization on every sphere of our lives requires us to take this debate a step further to ensure that the human rights framework adequately addresses the ensuing challenges.

12. Robots and artificial intelligence will radically transform our lives, including the concept of care of older persons. This is not meant to be a prophecy, but a call for reflection

and, eventually, action to ensure that the human rights of older persons are effectively protected today and in future.

13. Whereas older persons constitute the most heterogeneous of all age groups, many individuals at some point require support to retain their autonomy and independence and to remain fully integrated in society. The availability, accessibility, acceptability and quality of assistance is compromised due to the increased pressure of demographic ageing, which, in combination with the shortage of health and social care professionals and economic constraints, limit the options for formal support, especially at home. This scenario does not only affect western States, but increasingly also developing countries.[2]

14. Against this background new technologies, including assistive devices, built-in environmental applications and robotics are gaining traction as cost-effective and efficient solutions to the increased need for individualized support for older persons. Such technology can perform simple, routine tasks, such as bringing meals and medications to patients, which will free up human staff who could dedicate themselves more to those elements or parts of care that require human interaction. As their development progresses, those robots begin taking on more and more medical or caregiving tasks and operate increasingly autonomously. For authority to shift from humans to algorithms, their performance only needs to exceed the average human performance.

15. Assistive and robotics technology is and will be used in three main areas, namely to help monitor the behaviour and health of older persons; to assist them or the caregiver in their daily tasks; and to provide for social interactions. Each of those areas touches inevitably on the enjoyment by older persons of their human rights, including their dignity and autonomy, informational self-determination and non-discrimination and equality. In the present report, the Independent Expert seeks to examine the potential, challenges and ambiguities of the progressive use of assistive and robotics technology for the human rights of older persons.

B. Legal and policy framework

16. There is no specific reference to the right to assistive technology in the United Nations Principles for Older Persons, the International Covenant on Civil and Political Rights or the International Covenant on Economic, Social and Cultural Rights. In the absence of a dedicated instrument on older persons and while not applicable to all older persons, the provisions in the recently adopted Convention on the Rights of Persons with Disabilities offer some guidance as they recognize the importance of access to assistive technology. The Convention affirms that assistive technology is essential to enable persons with disabilities to live independently (art. 19) and to participate fully in all aspects of life (art. 29). It emphasizes that affordability and accessibility are necessary to ensure that assistive technology is available on an equal basis to everyone, everywhere.

17. Under article 20 of the Convention, States have an obligation to take effective measures to ensure personal mobility with the greatest possible independence, including by facilitating access by persons with disabilities to assistive technology. States should also promote the availability of assistive technology, giving priority to technologies at an affordable cost; undertake research in this area; and provide relevant accessible information to persons with disabilities (art. 4). Based on the principle of universal design under article 2 in conjunction with article 9 of the Convention, technologies must be accessible to everyone on an equal basis. Furthermore, under the Convention, States are requested to engage in knowledge transfer through international cooperation.

18. The Committee on the Rights of Persons with Disabilities, in its draft general comment No. 5 on article 19, seeks to clarify that persons with disabilities should retain

[2] Office of the United Nations High Commissioner for Human Rights, "Normative standards in international human rights law in relation to older persons: analytical outcome paper, August 2012". Available from http://social.un.org/ageing-working-group/documents/ohchr-outcome-paper-olderpersons12.pdf.

control over their living arrangements. Those are not limited to the place of residence, but include daily schedule, routine, way of life and lifestyle of a person, covering private and public spheres in a daily and long-term dimension. It further provides that involuntary placement and treatment is incompatible with the Convention. Although to date the Committee has not specifically addressed whether support provided through assistive and/or robotics technology can be imposed on individuals, such interpretation is understood as being incompatible with the principle of autonomy and would therefore run counter to the Convention.

19. According to the Special Rapporteur on the rights of persons with disabilities, access to quality support, including in the form of assistive devices and technology, derives from the basic principles of human rights, such as dignity, autonomy, equality, non-discrimination, participation and inclusion. States therefore have an obligation to ensure access to a wide range of support services to persons with disabilities. Support is a human rights obligation arising from various rights, including the right to an adequate standard of living, the right to social protection, the right of everyone to the enjoyment of the highest attainable standard of physical and mental health and the right to education. While the obligation to provide support refers to individualized measures, the obligation of accessibility requires States to take action to create societies that are more inclusive (see A/HRC/34/58).

20. The Committee on Economic, Social and Cultural Rights considers access to assistive support intrinsic to the right to an adequate standard of living. In its general comment No. 5 (1994) on persons with disabilities, it noted the need to ensure the availability of support services and assistive devices for persons with disabilities as part of article 11. There is no explicit reference, however, to assistive technology in its general comment No. 6 (1995) on the economic, social and cultural rights of older persons. The Committee merely draws on the Vienna International Plan of Action on Aging, which states that national policies should help elderly persons to continue to live in their own homes as long as possible through the restoration, development and improvement of homes and their adaptation to the ability of those persons to gain access to and use them.

21. The United Nations Principles for Older Persons provide that older persons should be able to reside at home for as long as possible (principle 6). This, however, leaves a wide margin of appreciation as to when support at home is no longer sufficient.

22. No explicit reference to assistive technology is contained in regional standards on the rights of older persons. It is suggested in the Inter-American Convention on Protecting the Human Rights of Older Persons that living environments should be adapted to the preferences and needs of older persons and that States should provide home-care services that enable older persons to reside in their own home, should they so wish (art. 24). Along similar lines, the Committee of Ministers of the Council of Europe, in its recommendation CM/Rec(2014)2 on the promotion of human rights of older persons, states that care services "should be available within the community to enable older persons to stay as long as possible in their own homes" (para. 30) and that States should help with covering the costs, if necessary. There is no clear obligation, however, for States to provide support for older persons.[3] Moreover, the Committee of Ministers states that access to care in the community may be limited and assumes that under certain conditions older persons may be forced to leave their homes and enter into residential settings (para. 40).

23. It is emphasized in the Madrid International Plan of Action on Ageing, 2002 that assistive technology and supportive environments can prevent disability in old age and lead to cost savings (para. 61). Moreover, technology can reduce barriers in access to health (i.e. telemedicine) and education (i.e. distance learning) and can support rehabilitation. According to the Madrid Plan of Action, medical technologies need to be affordable and accessible to ensure availability to everyone without discrimination. Whereas these provisions establish the importance of assistive technology for older persons, the Madrid

[3] Council of Europe, Parliamentary Assembly, report by the Committee on Social Affairs, Health and Sustainable Development on the human rights of older persons and their comprehensive care, Doc. 14320.

Plan of Action seems to adopt a medical model to assistive technology, failing to integrate a comprehensive human rights-based approach that sees support as an obligation based on the rights to an adequate standard of living and independence, and as a precondition of equal and full participation in society.

24. It follows from the above that existing normative and policy frameworks have not explored the full potential of adequate and appropriate support that may allow older persons, in particular through assistive and robotics technology, to continue living in the place of their choice without restriction. There is no mention of the use of assistive technology in residential settings, and the few references that exist focus on medical technologies, failing to encompass the full range of devices that can assist older persons to fully participate in society on an equal basis with others.

C. Human rights impact

1. Autonomy and automation

25. Autonomy is a central element in the discussions about assistive and robotics technology for older persons (see A/HRC/30/43, para. 66).

26. Assistive devices and robotics can compensate for physical weaknesses by enabling older persons to eat, bathe, shop or get out of bed on their own. They can enhance their capacity to self-manage daily activities, such as shopping or cleaning, without being dependent on caregivers or family members. Smart living environments, including sensors and other applications that monitor older persons' health and behaviour, and help prevent hazards, can enable them to live independently in their own homes and avoid entering residential settings. Electronic bracelets, assistance through a global positioning system (GPS), technology-augmented travel applications and other accessible solutions allow older persons, including those with cognitive impairments, to travel and move about alone. Memory and communication applications can support older persons' cognitive capacity and by extension their independent living.

27. Overreliance on technology may by contrast create new forms of segregation and neglect, abandoning older persons in their private homes, without any links to the community. Unless communities, services and the built environment are accessible, older persons will not be able to be truly independent in accordance with article 19 of the Convention on the Rights of Persons with Disabilities, which recognizes the equal right of all persons with disabilities to live independently and be included in the community, with choices equal to others. Independent living must not be understood as absence of support. Instead, a people-centred approach to independent living is necessary.

28. Clearly, assistive technology can build on the strengths of persons with dementia and reduce their dependency on others. If these persons are, however, used to doing certain things on their own, assistive technology may infantilize the persons concerned and also take away their choice and control and therefore breach their autonomy. In sum, the promise of independence should be balanced with other human rights. Solutions must comprehensively address the human rights of older persons.

29. Autonomy also extends to the right to refuse a certain form of support, such as a robot. The right to free and informed consent is enshrined in article 25 of the Convention on the Rights of Persons with Disabilities. It is required to obtain the specific consent of a person in advance of every intervention. This requirement needs to be extended to support older persons through technological means, including robots. Others should not be allowed to give consent on their behalf. The obligation to obtain consent needs to include a duty to appropriately consult older persons and to ensure that they are not unduly influenced in their decision on the use of technology. As technology acceptance may fluctuate over time, older persons should also be able to change their minds and opt out of technology at any time. Unless there are viable alternatives, the older person does not, however, have a real choice. Consent is not merely an administrative requirement. It is an essential element to a rights-based approach.

30. A prerequisite is that simple and accurate information about the technology be provided to every older person — not just to those with cognitive impairments — in order for them to be able to assess the implications of the use of assistive and robotics technology prior to giving their consent. Information has to be provided in such a manner that potential users will understand the risks and not overestimate the benefits of technology.

31. Depending on the personal circumstances and needs of an older person, diverse levels of support may be required to obtain consent. Particular safeguards are required for people with severe cognitive difficulties, including older persons with dementia. The process followed to obtain consent, including the manner in which people are being consulted, determines the extent to which older persons can make informed and autonomous choices.

32. Even if older persons consent to the use of monitoring devices, they must remain in control of what information will be gathered, how it will be used and with whom it will be shared. For example, can a surveillance system put in place to detect falls or neglect also collect data about the user's habits?

33. The right to autonomy extends also to the withdrawal of technology. Assistive technology should not be removed without the informed consent of the user. When technology has been applied for a long period, the impact on the older person's rights must be closely evaluated. This is especially important for robots, with which users may develop close bonds owing to their anthropomorphic features and functionalities.

34. Older persons' right to autonomy is at times limited on the ageist assumption that because someone is older, he or she has declining mobility or worsening memory and, therefore, they are not able to make decisions. The right of older persons to autonomous decisions can be limited because others, in particular family members and caregivers, act as substitute decision makers. When others decide on behalf of the older person who will be interacting with the technology, the individual in question is not allowed to exercise his or her right to autonomy.

35. Technology could prompt and interact with older persons with cognitive impairments in a way that helps them navigate through their routine while maintaining choice and control about their everyday life. Based on close observation, systems might be able to suggest what a person with communication difficulties wishes. While such tools can increase individual autonomy, there are risks of abuse as there is a fine line between suggesting action and directing the person into a specific activity. As a matter of fact, many choices people consider their own are already to a great extent determined by algorithms.

36. Progress in the area of machine learning and artificial intelligence raises the question of driven or automatic decision-making. Self-learning technology may be a powerful tool to personalize services for older persons. Systems could learn the users' routine and automatically adapt to their preferences, for example for eating times. Self-learning technology would need to be programmed in a manner that allows older persons to retain control as preferences change and to be able to adapt to unexpected changes, such as unannounced visits. As technology becomes more sophisticated and autonomous, a human rights-based approach needs to be integrated in the design, planning and implementation of the systems.

37. It is important in this regard to clarify that robots should not be able to substitute themselves for the decision-making of an older person. The human control paradigm implies that it should not be possible to delegate a decision with legal effects to an automated process. Artificial intelligence may, however, assist older persons to provide answers to their questions and to review the options, thus enabling them to reach their own decisions in a similar manner to the notion of supported decision-making. This will, however, require clear parameters and safeguards to ensure that the preferences of older persons will be respected and adequately reflected.

38. Respect for individual autonomy also means that older persons need to be allowed to deviate from what is expected of them. This is of particular importance in case of conflicting instructions to the assistive technology or robot from the caregiver and the older person. Safeguards are needed so that the choice of a person, for instance not to take

prescribed medicine or follow a certain regime, is respected and to prevent the robot from coercing the older person into adhering to the caregivers' instructions.

39. Older persons must not only retain the whole range of decision-making powers other adults have, but they should also not be penalized for their decisions. Systems may for, instance, signal a deviation from prescribed or expected behaviour to other actors, such as caregivers, health professionals or even insurance companies. A human rights-based approach prescribes that autonomy must prevail in the use of assistive and robotics technology.

2. Dignity and human rights

40. Dignity is the founding principle of human rights law and underpins international policy documents on ageing. Given that human rights developed in response to specific violations of human dignity, they may thus be regarded as specifications of human dignity.[4] Measures and policies related to ageing require a human rights footing in order to be apt in defining the extent to which older persons can live in dignity.

41. The use of assistive technology and robotics in the care of older persons can either enhance or compromise their dignity. It therefore needs to be rigorously scrutinized. The use of restraints, disempowering practices, and neglect of the users' needs and preferences have been found to violate the standard of dignity in care settings. A robot, for instance, that moves people around or feeds them without consulting them may amount to an undignified way of providing services. The obligation to wear a special uniform at all times to prevent falls, without any consideration of the disgracing effect towards older persons, may violate a person's dignity (see A/HRC/22/53).

42. The introduction of assistive technology and care robots raises questions about the kind of care society seeks to provide to older persons. Policy decisions reflect society's values and biases. Assistive technology and robotics promise a large potential in sustaining older persons' independence and improving their quality of life. However, when technology becomes an end point, it might restrict the full potential of older persons as well.

43. Insofar as technology does not help older persons regain agency and fulfil their aspirations, it maintains a dependency culture. Where robots remain the only form of interaction for older persons, technology may even become debilitating and anchor a paradigm of disempowerment.

44. The introduction of technology cannot substitute for the State's obligations to support older persons. It should also not lead to a collective disengagement from the duty to support them. Evading social responsibility for this group, as in practice society discounts older persons' inherent worth, breaches the universality of the right to support. Adequate support is a precondition for the effective exercise of all human rights on an equal footing with others and therefore to live with dignity.

45. Overreliance on technology may portray older persons as a burden rather than human beings with inherent dignity. Attention must be paid, so that technology targeting the older population does not stigmatize older persons as frail and needy of assistance. Technologies that reinforce stereotypical images of older persons and nourish their oppression, exclusion and segregation do not comply with human dignity, despite their promise to enhance autonomy and independence.

46. An issue raised in relation to the introduction of assistive technology and robotics in care is the objectification of older persons. Care is not merely a form of service provision, it is both the attitude of concern for the individual and the actual activity of caregiving and, as such, it confers value on the care recipient. If assistance is provided in a manner that diminishes the individual, it is disrespectful of the person's dignity.

47. The human touch is considered an important part of caring. It is a necessity for people's well-being and feelings. A paradigm of care that solely or primarily relies on

[4] Cf. Jürgen Habermas, "The concept of human dignity and the realistic utopia of human rights", *Metaphilosophy*, vol. 41, No. 4 (2010), pp. 464-480.

technology entails the risk of dehumanizing care practices. That includes the risk of losing one's sense of identity, self-esteem and control over one's life, and overall raises concerns about human dignity. Views diverge on the extent to which robots can compensate for human contact,[5] also taking into account that loneliness is a common source of distress and suffering for older persons and impairs their quality of life. User acceptance depends on a variety of factors, including the characteristics of the technology itself, and also on the availability of alternatives, personal preferences and social and cultural determinants.

48. Assistive technology cannot substitute for human care. The extent to which it is appropriate to rely on a machine instead of a human will, however vary, depending on the context, task and individual. Based on a human rights-based approach, support should be available as a means to expand opportunities and not as a method of maintenance. Assistive technology should enable human capabilities and enhance human dignity. This aim should be integrated from the conception to the application of assistive devices and robotics.

3. Informational self-determination

49. The use of assistive technology and robotics will have an impact on the right to privacy, namely the protection of personal data, and informational self-determination (see para. 54 below) in a significant and unparalleled manner. Information gathered through the use of assistive technology and robotics by older persons will be particularly sensitive as it pertains to the health of individuals, their life choices, political, philosophical and religious beliefs, sexual habits, etc.[6] This may concern the older persons themselves, and also their caregivers, family and friends.

50. For robots to function effectively and properly and to maximize the opportunities for their use and benefits, they will generate, centralize and share vast and unprecedented amounts of data on health and other sensitive information. As the devices become more autonomous, data collection will further expand, since these systems function on the basis of data collection and analysis, and concerns over data protection will therefore be magnified. Challenges for privacy will further increase with the devices communicating with each other and having access to remote servers where information from other robots is stored in order to learn from their experiences. Particularly in home care, assisted technology and care robots will intersect with the assisted-living technologies and other electronic devices, such as smartphones or tablets. The "glass human being" is therefore no longer just a literary metaphor.[7]

51. The right to privacy under article 17 of the International Covenant on Civil and Political Rights covers arbitrary or unlawful interference with one's personal privacy, family, home or correspondence. Data gathering and other forms of invasion of personal and domestic privacy must only take place after obtaining the informed consent of the individuals concerned (i.e. older persons and others whose information may be collected). Users should be able to understand fully the extent of monitoring, including how data are gathered and processed, by whom, for what purpose, for how long and where they are stored and with whom they are or can be shared.

52. Monitoring technologies could result in unwanted supervision and could even take place without an older person's conscious knowledge. Older persons may be discouraged

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[5] For instance, according to John Hudson, Marta Orviska and Jan Hunady, "People's attitudes to robots in caring for the elderly", *International Journal of Social Robotics*, vol. 9, No. 2 (2017), pp. 199-210. A European study found that most pensioners living in cities supported the use of robots in care. However, another study found that 60 per cent of European Union citizens want to ban robots in care.

[6] Tom Sorell and Heather Draper, "Robot carers, ethics, and older people", *Ethics and Information Technology*, vol. 16, No. 3 (2014), pp. 183-195; cf. Niklas Luhmann, *Grundrechte als Institution*, Schriften zum öffentlichen Recht, 5th ed., vol. 24 (Berlin, Dunker and Humblot 2009).

[7] Cf. Friedrich Graf von Westphalen, "Auf dem Weg zum gläsernen Bürger? Das Volkszählungsgesetz 1982", *Die neue Ordnung*, vol. 37, No. 2, 1983, pp. 136-142; Hans Ulrich Buhl and Günter Müller, "The 'transparent citizen' in Web 2.0", *Business and Information Systems Engineering*, vol. 2, No. 4, (2010), pp. 203-206; and Joel R., Reidenberg, "The transparent citizen", *Loyola University Chicago Law Journal*, vol. 47 (2015), pp. 437-463, Fordham Law Legal Studies Research Paper No. 2674313. Available from https://ssrn.com/abstract=2674313.

from engaging in certain activities or behaviours for fear of being watched. The more invisible and unobtrusive the technology, the less likely users may fully comprehend its privacy implications. Moreover, "once robots have the skills to communicate and interact, not only will they exchange data (among themselves; between themselves and an entity), but this communication may be imperceptible to humans".[8] The implications for privacy of such exchanges must be better understood and assessed.

53. Other concerns relate to processing and storage of data. According to article 17 of the International Covenant on Civil and Political Rights data processing should not take place for any purpose other than the one originally consented to, and information beyond what is necessary to achieve the purpose should not be gathered (principle of data minimization). In addition, private information should not be used for purposes incompatible with the Covenant. Information must not be kept for longer than necessary. Users should, moreover, retain control over the use of their data and be able to change their mind about data retention and processing. In its general comment No. 16 on the right to privacy, the Human Rights Committee stated, moreover, that the gathering and holding of personal information on computers, data banks and other devices, whether by public authorities or private individuals or bodies, must be regulated by law (para. 10). Quantitatively, there will be a significant difference when applying the principle of data minimization to robotics and artificial intelligence rather than human interactions, as these technologies, by definition, require vast amounts of data to function properly. Data quality and relevance are essential aspects in deciding what data should be collected and stored in the digital age. Furthermore, the principle of data minimization offers useful guidance to determine what data should be stored and for how long, or what information should be shared and in what format, i.e. whether it should be anonymized.

54. The right to informational self-determination, as defined by the German Federal Constitutional Court, is intrinsic in an individual's general right of personality and their dignity, and constitutes the authority of the individual to decide for himself or herself, on the basis of the idea of self-determination, when and within what limits facts about his or her personal life shall be disclosed.[9] Therefore, an older person, in accordance with the right to informational self-determination, has to be able "to decide what information about himself should be communicated to others and under what circumstances".[10] Besides disclosure, the protection extends to collection, storage and use, and it also involves the right to rectify records and to be forgotten, including the right to retain control of what becomes of the post-mortem reputation and legacy. The right to be forgotten is particularly important when a person no longer consents to the use of assistive technology.[11] Understanding the impact of autonomous robots on the right to informational self-determination requires an appreciation of the ways in which data are, and will be, utilized by care robots.

55. The use of technology also has the potential to enhance privacy. In residential settings, where privacy is, by definition, compromised as a result of shared living arrangements and caregiving duties, technology could offer opportunities to create zones of intimacy.[12] Electronic bracelets, for instance, may allow older persons to move to more private spaces. There may also be a preference for intimate tasks, such as bathing or dressing, to be carried out by a machine instead of a human caregiver for reasons of

[8] Nathalie Nevejans, "European civil law rules in robotics: study for the JURI Committee", European Parliament, Directorate-General for Internal Policies, Policy Department C, Citizens' Rights and Constitutional Affairs, Legal Affairs, 2016, p. 22.

[9] German Federal Constitutional Court, BVerfGE 65, 1, II 1 (a).

[10] Alan F. Westin, *Privacy and Freedom* (New York, Atheneum, 1967).

[11] See, e.g., Court of Justice of the European Union, *Google Spain SL and Google Inc. v. Agencia Española de Protección de Datos and Mario Costeja González*, Case C-131/12, available from http://curia.europa.eu/juris/document/document_print.jsf?doclang=EN&docid=152065, Viktor Mayer-Schönberger, "Useful void: the art of forgetting in the age of ubiquitous computing", KSG Working Paper No. RWP07-022, April 2007, available from https://ssrn.com/abstract=976541

[12] Alistair Roelf Niemeijer, *Surveilling Autonomy, Securing Care: Exploring Good Care with Surveillance Technology in Residential Care for Vulnerable People* (Amsterdam, VU University Press, 2015).

personal intimacy. Technology may also allow older persons to develop remote relations without the risk of others invading private moments.

56. A collateral concern of privacy relates to information about the functioning of devices, such as algorithms, particularly in the event of their potential misuse or malfunctioning, which could cause harm to users. In such instances, privacy should not be used as a pretext by developers and companies not to disclose information, on the grounds that it is sensitive, if it is required to establish responsibility, including negligence or to challenge driven or automatic decision-making. Again, personal information should only be disclosed if necessary for a specific, well-defined purpose, bearing in mind that not every investigation of every form of malfunctioning would justify interference with privacy rights and that it would be necessary to strike a balance among conflicting rights.

4. Equality and non-discrimination

57. Non-discrimination is an immediate and cross-cutting human rights obligation. Age is a prohibited ground in several contexts, but because of the lack of a clear prohibition of age discrimination in all aspects of society, age-based distinctions are often considered legitimate or even necessary.

58. States must ensure that all older persons enjoy equal access to assistive technology without discrimination. Eligibility criteria for the provision of assistive devices must follow a human rights-based approach to ensure that they are not discriminatory. There are, for instance, age limits in access to disability benefits and mobility allowances that can be used for the purchase of assistive devices. Such criteria constitute discrimination on the basis of age and it must therefore be carefully assessed whether, while benefiting certain groups, they exclude others who have an equal right and comparable need to access the support.

59. The introduction of advanced assisted technology might amplify the existing gap in access to such forms of support and also create new inequalities. The affordability of the system will have an impact on the uptake of technology and therefore equality, inclusion and the enjoyment of all other human rights (i.e. autonomy), which such technologies are supposed to enhance.

60. Special attention needs, moreover, to be paid to older persons who are disproportionately disadvantaged in terms of access to support, such as migrants, refugees and asylum seekers, indigenous peoples, ethnic, racial and cultural minorities, stateless persons, those in conflict or humanitarian situations, and other marginalized segments of the population. The introduction of assistive technology must not lose sight of those inequalities.

61. Furthermore, to be truly inclusive, technology must reflect the diverse preferences and lifestyles of older persons based on age, disability, nationality, ethnicity, religion, gender, status, etc. There is some evidence that artificial intelligence could reproduce and amplify human bias and as a result automated machines could discriminate against some people. Biased datasets and algorithms may be used in judicial decision-making, medical diagnoses and other areas that have an impact on older persons' lives. Auditing machine-made decisions and their compliance with human rights standards, is therefore considered necessary to avoid discriminatory treatment.

62. On the basis of an analysis of the data collected about an older person's routine and behaviour, technology may, for instance, detect early signs of Alzheimer's disease. While early intervention may be critical in the case of Alzheimer, the older person concerned should have consented to data being collected for the purpose of making such a diagnosis and necessary and adequate provisions need to be taken in order to ensure appropriate preparation for acceptance and a course of action, particularly if he or she does not show any visible symptoms. If misused, such knowledge could lead to stigmatization of the older person.

63. Universal design is intertwined with the right to equality and non-discrimination, since it is the gateway through which everyone can participate fully and equally in society. Lack of access to assistive products and services restricts the enjoyment of human rights that are dependent on support through technology.

64. Assistive products are primarily targeted at high-income markets. To avoid creating a wider divide and ensure that everyone has equal access to technological development regardless of their place of residence, North-South collaboration in terms of knowledge transfer, research and technical and economic assistance is essential. Low-income countries should be guided in accessing and developing assistive and robotics technology and in planning their deployment on the ground through market, procurement, service provision and training policies.

5. The right to liberty and security

65. Technology is increasingly used as an alternative to physical or chemical restraint (i.e. through medication). Setting boundaries for people with cognitive impairments to roam safely is, for instance, part of dementia care.[13] Electronic bracelets and GPS systems are used as a substitute for locked doors or chemical sedation.

66. While a number of national laws permit such practices of deprivation of liberty on the grounds of actual or perceived impairment, notably when the individuals in question are deemed dangerous to themselves or others, the Committee on the Rights of Persons with Disabilities established that the right to liberty and security of persons with disabilities is absolute. According to the Committee, such practices are discriminatory in nature and amount to arbitrary deprivation of liberty.[14]

67. Rather than restricting their rights, assistive devices should therefore provide older persons with cognitive impairments the support necessary to enable them to exercise their rights. Alternatives to deprivation of liberty and restraints for older persons suffering from dementia may include multi-sensory environments, augmented reality and support escorts.[15]

68. Another central aspect is that the older person should retain control over the use of technology. If the person prefers not to use technology or feels overly restricted, alternative measures must be provided.

6. Participation in social and public life

69. Participation is a core human rights principle and also a requisite of a human rights-based approach. The United Nations Principles on Older Persons also recognize that older persons should participate actively in the formulation and implementation of policies that directly affect their well-being (principle 7).

70. As a right, participation has also been enshrined in the core human rights instruments, notably in the Universal Declaration of Human Rights (art. 21), the International Covenant on Civil and Political Rights (art. 25) and the International Covenant on Economic, Social and Cultural Rights (art. 15). Participation and inclusion are principles that permeate the Convention on the Rights of Persons with Disabilities (art. 3) and are protected under dedicated articles about public and cultural life (arts. 29-30) and about implementation and monitoring mechanisms (arts. 4 and 33-35).

71. Assistive and robotics technology can facilitate older persons' participation in decision-making, through online polls and surveys and improved access to information about social and political developments in their community, help them access voting stations or enable remote consultation with government bodies. Moreover, they can assist older persons to take part in leisure activities, and access online shopping and government

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[13] Arlene Astell, "Technology and personhood in dementia care", *Quality in Ageing and Older Adults*, vol. 7, No. 1 (2006), pp. 15-25.

[14] Guidelines on article 14 of the Convention on the Rights of Persons with Disabilities: the right to liberty and security of persons with disabilities.

[15] Jane Tilly and Peter Reed, "Falls, wandering, and physical restraints: a review of interventions for individuals with dementia in assisted living and nursing homes", *Alzheimer's Care Today*, vol. 9, No. 1 (2008), pp. 45-50; Sherry Markwell, "Long-term restraint reduction: one hospital's experience with restraint alternatives", *Journal Nursing Care Quality*, vol. 20, No. 3 (2005), pp. 253-260; and Eileen M. Sullivan-Marx, "Achieving restraint-free care of acutely confused older adults", *Journal of Gerontological Nursing*, vol. 27, No. 4 (2001), pp. 56-61.

or banking services. Solutions based on information and communications technology can also help create virtual communities and digital neighbourhood platforms for community-building, and allow older persons to participate in online mutual support services and seek advice.

72. Participation begins with the direct involvement of older persons in the design and development of assistive products and extends to the planning, delivery and evaluation of services. It is also about ensuring their inclusion at all levels of decision-making. It is about making older persons equal partners in the process, using genuine bottom-up approaches (i.e. co-design or co-construction). Specific efforts must be made to include marginalized groups and those not adequately covered in representative organizations of older persons, such as indigenous people, migrants and refugees, ethnic, cultural or linguistic minorities, and those with complex support needs.

73. The use of robots and assistive devices may potentially lead to a reduction in the amount of human contact. While during the introduction of new systems interaction with health workers may increase, the use of robots for tasks such as lifting, carrying or even cleaning might ultimately reduce an older person's social contact with humans. Even if interactions with robots, for instance, social companion robots, could be potentially beneficial for the physical and emotional well-being of older persons, the extent to which they may replace reduced or missing interactions with humans, and any potential risks in this regard, should be thoroughly assessed.[16]

74. Technology may perpetuate the view that older persons are inert and in need of protection. Robotics and other types of technology should not prioritize certain forms of participation, i.e. they should not merely seek to facilitate remote interaction from home, and should not create distraction as a form of respite for caregivers. Some systems can augment cognition. They allow the user to make choices and lead the interactions (for example, the Computer Interactive Reminiscence and Conversation Aid).[17] They can be tailored to the individual's circumstances and preferences, and can also ensure the right of the user to be left alone.[18]

7. Adequate standard of living

75. The right to an adequate standard of living requires, at a minimum, that everyone should enjoy the necessary conditions of support they need. That involves the availability of support services and assistive devices. Unless older persons have access to the support they require, they will not be in a position to fully enjoy their human rights, such as the right to an adequate standard of living. Such services and devices must not only be generally available in the market, but they should comply with the principles of availability, accessibility, acceptability and quality.

76. Assistive technology must be available in sufficient quantity and accessible to all older persons, without discrimination and especially for the most disadvantaged older persons and those with high support needs. It should be tailored to the diverse spectrum of the needs of the older population and be available within easy reach, based on individual circumstances. Solutions that are only available in certain geographical areas, such as cities, or that are only offered in specific settings, such as homes for older persons, do not comply with the principle of accessibility.

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[16] E.g. PARO, a robot seal, which is used for therapeutic purposes, or MARIO robot, which is used in dementia care for memory recall and cognitive skills and can verbally interact with patients via voice-activated software; see also, e.g., Shuzhi Sam Ge and others, eds., *Social Robotics: Second International Conference on Social Robotics, ICSR 2010, Singapore, November 23-24, 2010 Proceedings* (Berlin/Heidelberg, Springer, 2010).

[17] Astell, "Technology and personhood in dementia care".

[18] Tomoko Saito and others, "Relationship between interaction with the mental commit robot and change of stress reaction of the elderly", paper presented at the International Symposium on Computational Intelligence in Robotics and Automation of the Institute of Electrical and Electronics Engineers, 16-20 July 2003, Kobe, Japan.

77. Affordability of assistive services and robotics is a key element in ensuring access to such devices. While it is subject to progressive realization, States should include the provision of essential assistive devices and technology in the coverage of national health insurance and/or social protection schemes, on the basis of the World Health Organization priority assistive products list, and should also consider waiving import duties and taxes on assistive devices and technology that are not produced domestically (see A/HRC/34/58, para. 52).

78. The adequacy of support may depend on the "prevailing social, economic, cultural, climatic, ecological and other conditions".[39] Gender, income and housing disparities that impede access to adequate support must also be addressed.

8. The right to health

79. Assistive technology and health robots have great potential to contribute to older persons' enjoyment of their right to the highest attainable standard of health. Technologies that promote healthy lifestyles can help older persons prevent diseases and maintain their good health. Remote monitoring can reduce the need for acute health care, diagnose early symptoms, facilitate early interventions and reduce the need for face-to-face medical visits, especially for those lacking easy access to health centres. Telehealth solutions or other similar applications can help older persons better manage chronic diseases. Robots can improve the rehabilitation of patients and therefore enhance their functional capacities. Assistive technology can help older persons build or sustain their cognitive and communication skills, and social robots may have benefits for older persons' mental health.

80. Remote services and assistive devices should, however, complement and not replace conventional care. They should not impede equal access to formal health services, for instance in the form of higher fees for visits of medical professionals or as a result of lack of insurance coverage for such health services. Health resource allocation should not favour expensive technological solutions targeting a small, privileged fraction of the population over other services that can help larger parts of the population.

81. An integrated approach to assistive technology encompasses prevention, cure, disease management, rehabilitation and palliative care. As the right to health is heavily dependent upon the realization of other rights and upon equal access to underlying determinants of health, such as adequate housing and food, a comprehensive response, beyond the use of assistive technology and robots, is necessary. A life-cycle approach to the right to health should involve age-appropriate technologies and should extend to the care for chronically and terminally ill persons.

9. Protection from abuse, maltreatment and violence

82. Insofar as assistive technology and robotics may improve the quality of support and fill existing gaps in the provision of care, it can contribute to prevent instances of elder abuse and violence against older persons. Professional care workers are in such high demand that the inadequacy of their qualifications and training are often overlooked. Informal caregivers might be inadequately equipped to care for their loved ones. Effectively designed robots could help meet this demand in a safer and more responsible, sustainable manner. This may effectively lead to a reduction in instances of abuse, maltreatment and violence against older persons in home-care and institutional settings.

83. Monitoring technology may deter abuse and neglect, and allow for their detection, since day-to-day monitoring provides insights into older persons' physiological health, activity levels and interaction with others. It must not, however, be used as a tool to monitor the actions of health workers, which would be in violation of employees' right to privacy at work.

84. Overreliance on technology may turn into a form of neglect of older persons as caregivers withdraw and the frequency and quality of interaction reduces. In the case of

[39] Committee on Economic, Social and Cultural Rights, general comment No. 12 on the right to adequate food, para. 7.

machine learning, there is a risk that the system could adopt the attitude of abusive caregivers, either through imitation or manipulation in the learning phase.[20] Technologies need to be able to recognize abuse, effectively intervene to avoid additional harm and make sure not to duplicate abusive behaviour.

10. Safety and physical integrity

85. Ambient-assisted technology and alarms are widely seen as helping to avoid unintentional bodily harm. Mobility monitoring, voice response, fire and flood detection, wandering detection and prevention, automatic locking/unlocking of doors and switching off of devices can prevent falls and other hazards, ensure intervention in a case of emergency and make an older person feel more secure.

86. While harm prevention is one of the fields of application of assistive and robotics technology, such technology also raises some safety concerns. Robots operate side by side with humans in an environment that is usually not well defined, such as the home, and are used by non-specialists, who may in addition have declining abilities or cognitive impairments. Malfunctioning technology can also constitute a hazard for older persons. Damage caused by assistive devices or robots can usually be attributed either to a machine defect or to faulty usage. With progress in machine learning, the risks of that technology are hard to predict. Another potential source of harm are cyberattacks, which could have an impact on the system and indirectly cause harm. Safety regulations and premarket assessments need to take account of these specificities to ensure older persons' physical integrity.

IV. Conclusions and recommendations

87. **A worldwide aging population will increase the demand for assistive technology and robots in the care of older persons, as they may perform tasks that human beings cannot do, do not wish to do, or cannot do as well or as efficiently. This trend will particularly affect home care in line with the wish of older persons to stay in the home for as long as possible.**

88. **Whereas most assistive technology and many of the currently deployed robots represent automatic systems that act according to a preprogrammed script, emerging technology operates with far greater levels of autonomy, ranging from systems that remain supervised by a human to fully autonomous robots enabled through artificial intelligence, which determine independently and dynamically if, when and how to execute a task.**

89. **The use of assistive technology and robots has great potential to increase the ability of older persons to live independently and autonomously, and to fully exercise their human rights on an equal basis with others. Effectively designed robots could help meet the increasing demand for care in a safer and more responsible, sustainable manner by reducing the prevalence of elder abuse and violence against older persons. There may be a preference for robots over humans in home care,[21] not only because of their greater physical capacity, but also for their potential to provide emotional care and support.[22] Even if interactions with robots, for instance social companion robots, might be beneficial for the physical and emotional well-being of older persons, the extent to which they may replace reduced or missing interactions with humans, and any potential risks in this regard, should be thoroughly assessed. As robots will carry**

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[20] Tay for instance was as an artificial intelligence chatbot, which soon after its release on Twitter in March 2016 began to post inflammatory and offensive tweets through its Twitter account. https://arstechnica.co.uk/information-technology/2016/03/tay-nazi-millennial-chatbot/.

[21] Jason Maderer, "How would you like your assistant — human or robotic?", 29 April 2013. Available from www.news.gatech.edu/2013/04/29/how-would-you-your-assistant-human-or-robotic.

[22] Barbara Peters Smith, "Robots and more: technology and the future of elder care", 27 May 2013. Available from www.heraldtribune.com/news/20130527/robots-and-more-technology-and-the-future-of-elder-care. See, e.g., PARO the therapeutic robot (www.parorobots.com).

out more caregiving functions, the benefit to older persons will depend on responsible design and use.

90. Existing and emerging technology, such as care robots, will increasingly operate autonomously, eventually performing actual care. This raises a number of concerns that, unless adequately addressed, may adversely have an impact on the human rights of older persons. This may require a review of the existing normative and policy frameworks to ensure that a human rights-based approach is being adopted to assistive technology.

91. Assistive technology and robots will collect, process and store unprecedented amounts of data. The use of information will increase in volume and complexity as robots carry out more and more autonomous functions. Understanding the risks of autonomous robots for the right to informational self-determination and privacy requires an appreciation of the ways in which data are, and will be, utilized by such technology. The existing normative framework, such as article 17 of the International Covenant on Civil and Political Rights, including the principle on data minimization, continues to provide essential guidance even though robots and artificial intelligence, by definition, require vast amounts of data to function properly. The implications of the use of assistive and robotics technology on the informational self-determination of older persons must be better understood and assessed.

92. The Independent Expert emphasizes that assistive technology as an essential measure to enable older persons to live independently and to participate fully in all aspects of life, on an equal basis with everyone, everywhere, needs to be affordable and accessible. Support for older persons should cover the diverse needs of older persons, including end-of-life and palliative care situations. However, the promotion of advanced technology, such as robotics, should complement and not detract from efforts to ensure that basic low-technology assistive products are available to everyone.

93. To ensure universal access, States should integrate assistive technology in health and social protection schemes, making it available at affordable prices and offering financial assistance to those who need it. Conditions of access must not be based on age alone. While promoting effective assistive technology, States must also retain other support options, including traditional care, and not create disproportionate disadvantages for individuals who may prefer, or whose needs are better catered for through, other forms of support. States should also establish monitoring and accountability mechanisms regarding the provision of assistive technology in order to evaluate the adequacy of support arrangements and prevent human rights abuses.

94. A human rights-based approach needs to be embedded in the design of assistive technology. A rights-based design ensures that the technology will not stigmatize older persons and will take account of their diverse needs and preferences, paying due attention to vulnerable groups, including those with high support needs, the cognitively and otherwise impaired, digital immigrants and others.

95. Human rights impact assessments of assistive and robotics technology should be undertaken to address human rights concerns and ensure compliance with international standards. Auditing machine decisions and algorithms, and their compliance with human rights standards, is essential in avoiding discriminatory treatment, including through biased algorithms. There is a need to develop concrete guidelines for such human rights impact assessments in consultation with developers and manufactures, but also service providers, procurers and civil society to ensure that a human rights-based approach can be embedded in the design, procurement, supply and implementation of assistive technology.

96. The informed consent of the user is paramount in the introduction of assistive technology and robotics. Older persons must be able to weigh the risks and the concrete benefits of the technology. Information must be given in an understandable way and language, bearing in mind individual personal circumstances and cognitive abilities. The paradigm of choice and control includes the right to opt out of the

assistive device at any time. Withdrawal of the system must not take place without the explicit consent of the user.

97. Older persons should be actively involved in the design and development of assistive technology and robotics. They must also participate in all aspects of decision-making about the introduction of assistive technology through public policies, including design, provision and monitoring. States need to take all necessary measures to ensure the active participation of older persons in research, development and policymaking, including by addressing structural barriers to their involvement. Robotics research activities should be conducted in accordance with the precautionary principle, anticipating the potential impact, while encouraging progress for the benefit of older persons and society at large.

98. It is essential that States raise awareness about the availability of assistive devices, by disseminating information to all relevant target groups. There is, moreover, a need to build the capacity of older persons and formal and informal caregivers to engage with assistive technology and robotics through targeted training. Information and training should be aimed at developing the digital skills necessary to use the technology and also to develop technological literacy to enable older persons and carers to understand and evaluate the benefits and risks of technology.

99. The Independent Expert stresses the need to explore further the substantive elements of a right to assisted living in old age, focusing on the intersection of ageing and disability and/or on how the right to care and support can be protected on the basis of a life-cycle approach. In this regard, the Independent Expert notes that the Committee on the Rights of Persons with Disabilities and the Committee on Economic, Social and Cultural Rights affirmed that assistive technology was essential in enabling persons with disabilities to live independently and to participate fully in all aspects of life. She stresses the importance for all human rights mechanisms to consistently address, in their deliberations and conclusions, the situation of older persons and the obligation of States to provide them with adequate support, including through assistive technology and robotics. Further guidance on how to ensure equality in old age is also needed in order to deal with age limits and other age-based barriers that impede older people's equal access to support.

100. There is a need to further explore appropriate mechanisms of accountability and monitoring of assistive technology and in particular of robots, including by engaging in discussions about the establishment of a dedicated watchdog on artificial intelligence, and ensure that such mechanisms adequately address the situation of older persons and are grounded on human rights standards.

101. The Independent Expert welcomes the work of the World Health Organization on assistive devices and technology and encourages all United Nations specialized agencies, programmes and funds to ensure a human rights-based approach to the development and implementation of assistive technology.

102. The Independent Expert notes that the 2030 Agenda for Sustainable Development and its call to leave no one behind present a unique opportunity to ensure that the introduction of advanced assisted devices and robotics in older persons' care does not deepen inequalities between developed and developing countries. Building on Goal 17 of the Sustainable Development Goals, she calls on States to enhance North-South, South-South and triangular regional and international cooperation and access to science, technology, innovation and knowledge-sharing.